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FARMERS' BULLETIN 396.

THE MUSKRAT.

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BY

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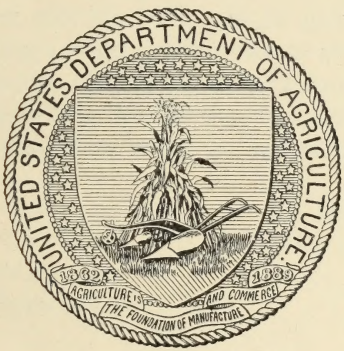
Assistant, Bureau of Biological Survey.



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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., February 25, 1910.

Sir: I have the honor to transmit a report on the economic value of the muskrat, by David E. Lantz, and to recommend its publication as a Farmers' Bulletin. The diminished numbers of fur-bearing animals and the enhanced value of all furs invite attention to every practicable means of conserving and increasing the supply. The muskrat is widely distributed and very abundant over large areas, and has become one of the first fur bearers in commercial importance. Its fur, while not of the highest quality, is adapted to a great variety of uses, and its flesh, unlike that of most fur bearers, has considerable food value.

Except in localities where its burrows endanger the safety of embankments, the muskrat should be protected by the establishment and enforcement of closed seasons, with proper provisions for trapping during the nonbreeding period. If muskrats are properly protected and not trapped to excess, the supply may be indefinitely maintained, and even increased, especially by the wise utilization of flooded marsh lands which are of little or no value for agricultural purposes.

Respectfully,

C. Hart Merriam,
Chief Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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THE MUSKRAT.

INTRODUCTION.

The present bulletin discusses the habits, economic relations, and value of the muskrat, or musquash (*Fiber zibethicus*). While this animal does considerable damage in some places, its harmlessness throughout most of its range and its increasing value as a fur and food animal justify its protection generally. Its wide distribution, prolific breeding, and hardiness, together with the fact that the areas it inhabits are not available for agriculture, make it a resource whose value may be greatly increased by careful husbanding.

GROWTH OF THE USE OF FURS.

The wearing of fur garments is as old as human history, but furs were slow in gaining favor in the temperate and warmer parts of Europe. Even in the middle ages their use was greatly restricted by sumptuary laws, which, on the plea of restraining extravagance, permitted the common people to wear only the inferior kinds. In several European countries sable was reserved for the nobility and ermine for the sole use of the royal families. Later, judges were allowed to wear ermine as officers and representatives of the king, and this concession was afterwards extended to all attendants on the court and servants of the royal family. The subsequent use of this fur by the nobility and clergy and finally by merchants and wealthy citizens are matters of history.

Royalty and nobility having approved the wearing of animal skins in temperate countries, the use of furs spread rapidly when once the restraining laws were repealed. The opening up of the interior of North America to trade brought largely increased supplies, until the number of fur-producing mammals slaughtered yearly became enormous. So great has been the demand for certain furs that the animals which furnish them have been hunted almost to extinction. Other important fur bearers are still found in large numbers, but each year trappers are obliged to go farther and farther in search of them. While the fur supply of the world is in no immediate danger of failure, present conditions are unfavorable to its indefinite continuance.

FIG. 1.—Muskrat.

SAVING THE FUR SUPPLY.

Although the outlook for a future fur supply adequate to the world's needs is unpromising, it is by no means hopeless. Four ways of increasing the present supply suggest themselves:

1. The use of pelts of domestic animals as a substitute for wild furs. In some parts of the world, dogs, goats, horses, and cattle are now bred principally for their pelts, which are used for both clothing and rugs. The full development of this idea would involve prolonged experiments in producing finer pelages by selective breeding.

2. Breeding fur-bearing animals under protection, either in a state of domestication or in a semiwild condition. Such animals would prove especially valuable for restocking parts of the country from which any species has been exterminated by excessive trapping.

3. Investigations to discover if any animals not now considered valuable for fur have pelts that may be utilized in the manufacture of clothing.

4. Conservation of the present supply. If furs from the three sources already mentioned can gradually be made to supplement the present output, much will be gained; but the chief dependence, after all, must be on a more careful conservation of the natural supply. This may be saved by laws restricting the taking of fur animals to proper seasons and protecting them at other times; and, in the case of species that are becoming rare, by laws forbidding their capture for a series of years. In addition, systematic restocking of territory depleted by trapping should be undertaken. It is believed that the muskrat may be made to play an important part in the conservation of the Nation's fur resources.

IMPORTANCE OF THE MUSKRAT.

While individual skins of the rarer fur bearers, like the sea otter and black fox, now command enormous prices, so few reach the market that their aggregate value is small compared with that of the commoner kinds. Even the beaver and the fur seal have so diminished in numbers as to be of less commercial importance than either the mink or the muskrat. The last two, in spite of their small size, assume importance as sources of fur by reason of their wide distribution and continued abundance. Mink remains our most popular as well as our most durable fur, but muskrat pelts not only have fair wearing qualities but are adapted to a great variety of uses. This fact and their abundance made the aggregate value of the muskrat skins sold in 1909 apparently greater than that of the mink. Only one other animal in the world, the European rabbit, exceeds the muskrat in the number of skins marketed. The London sales of muskrat pelts for the year 1905 exceed 5,000,000.

CLASSIFICATION AND DISTRIBUTION.

The muskrat belongs to a group of rodents known technically as the Microtinæ. The group has been separated into two divisions, the lemmings and the field mice, the latter including the common short-tailed meadow mouse (*Microtus*) of the Northern Hemisphere. The muskrats are very closely related to the field mice, but are larger, and have fur, feet, and tails more highly specialized for a life in the water. They differ from field mice of the genus *Microtus* particularly in having long, narrow, rudder-like tails, which are nearly naked, about as long as the body without the head, and thickest along the middle line.

Five species and eight subspecies (geographic races) of muskrats have been described.[a]

Muskrats are distributed over the greater part of North America, from the southern border of the United States to the barren grounds of northwest Canada and from the Atlantic to the Pacific. They seem to be absent from the coastal parts of South Carolina, Georgia, Alabama, and Texas; and from Florida and nearly the whole of California. Of course they do not occur in parts of the interior plateau that are devoid of streams or lakes.

DESCRIPTION.

The common muskrat when full grown is about four times as large as the ordinary brown rat. In general form it resembles the common meadow mouse (*Microtus pennsylvanicus*), but its tail is relatively very much longer and of different shape. The animal has a blunt muzzle, a short and hardly noticeable neck, and a stout body. The tail is characteristic of the genus, about two-thirds as long as the head and body, compressed, thickest along the middle line, and tapering to a rather acute point; the thinly scattered hairs do not

[a] The list of these forms follows:

Fiber macrodon Merriam. Type from Lake Drummond, Dismal Swamp, Virginia.

F. obscurus Bangs. Type from Codroy, Newfoundland.

F. occipitalis Elliott. Type from Florence, Oreg.

F. spatulatus Osgood. Type from Lake Marsh, Yukon, Canada.

F. zibethicus (Linn.). Type from eastern Canada.

F. z. aquilonius Bangs. Type from Rigoulette, Hamilton Inlet, Labrador.

F. z. hudsonius Preble. Type from Fort Churchill, Keewatin, Canada.

F. z. mergens Hollister. Type from Fallon, Nev.

F. z. osoyoosensis Lord. Type from Lake Osoyoos, Washington.

F. z. pallidus (Mearns). Type from Fort Verde, Ariz.

F. z. ripensis Bailey. Type from Carlsbad, N. Mex.

F. z. rivalicius Bangs. Type from Burbridge, La.

F. z. zalophus Hollister. Type from Bercharof Lake, Alaska.

conceal the small but distinctly marked scales. The eyes are small, black, and beady. The ears are short, covered with hairs, and in winter almost wholly concealed in the fur. The incisors are large and without grooves. The legs are short, expecially the front ones, while the feet are stout and provided with rather long claws. The hind feet are slightly webbed and so formed that they can be turned edgewise when carried forward while the animal is swimming.

Except the beaver, none of our inland fur-bearing mammals leads a more aquatic life than the muskrat. Its characters especially adapt it to the water. Besides having feet specialized for swimming, it has a tail which serves as an efficient rudder and fur which is practically waterproof. The long overhairs are close and glossy, and the underfur is exceedingly dense. The more common color of the muskrat is dark umber brown, the exact shade differing with the season and the locality.

Fur dealers recognize only one variety of the muskrat differing from the common color. This variety consists of the dark, sometimes almost black, skins collected in the Chesapeake and Delaware regions and in more limited numbers elsewhere. They are sold as "black muskrat," and command a higher price than the ordinary color. The species from which most of the black skins are derived is *Fiber macrodon*, which ranges chiefly in the tidewater region of the Atlantic coast from New Jersey to North Carolina.

The muskrat derives its name from the musky odor given off chiefly by its large perineal glands. The odor pervades the entire skin to some extent, particularly in summer. The name musquash, used by Richardson for this animal, is the Cree Indian name, and has the authority of long use, especially among fur dealers.

GENERAL HABITS.

While muskrats are chiefly nocturnal, they are much more active by day than many suppose. Where seldom disturbed, they may often be seen at work in bright sunlight, especially when building winter houses. These structures, though smaller and less strongly built, are in many respects similar to those of the beaver. (Fig. 2.)

HOUSES AND BURROWS.

Muskrat houses are composed of rushes, grasses, and roots and stems of other aquatic plants. The structure rests on the bottom of the pond, and is built mainly of the kinds of plants on which the animals feed. These are heaped up without orderly arrangement until the dome-like top rises from 18 inches to 2 or 3 feet above the water. The mud sometimes seen on the outside of muskrat houses

seems to be collected accidentally with the roots. From the part of the structure above the water an interior chamber is excavated, from which two or three passages lead downward through the mass to the water, reaching it at points well below the frost line. If the water is shallow, the animals excavate deeper channels leading from the house to various parts of the pond.

The houses are mostly for winter shelter and food and are seldom used as receptacles for the young. A single family usually occupies

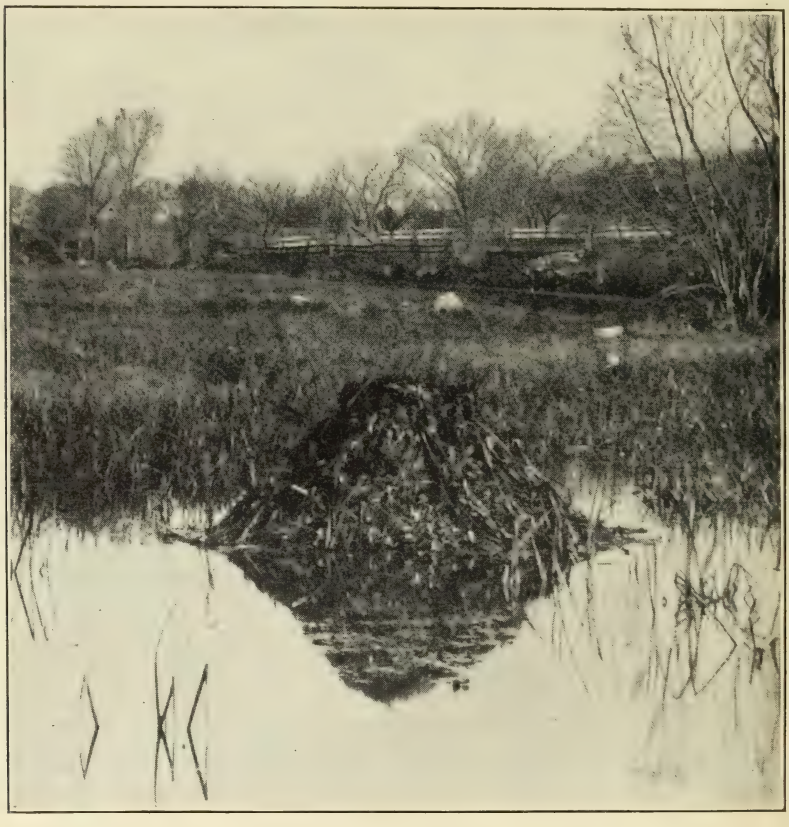

FIG. 2.—Muskrat house on Concord River, Massachusetts. (Photograph by William Brewster.)

a house. Occasionally, however, when driven from other houses or when excluded from underground burrows by barriers of ice or frozen ground, a larger number may temporarily occupy a house.

When banks of streams or ponds are high enough for the purpose, muskrats burrow into them. Entrances to the tunnels are almost always under water, and the approach to them is, if possible, by channels of sufficient depth to prevent ice from closing the passage. The tunnels extend upward into the bank above the level of the

water. They often rise to within a few inches of the surface of the ground and are frequently protected above by roots, or by trees and shrubs, or by thickly matted turf. These tunnels extend 10 to 50 feet into the bank and terminate in a roomy chamber which sometimes contains a bulky nest composed of dried vegetation. Usually two tunnels lead from the nest to the water, and often a tunnel has two branches or outlets.

When burrows are available, muskrats occupy them in winter and summer; but in shallow ponds and marshes, and especially in northern latitudes, the entrances are often closed by ice in winter. In such situations and when banks suitable for burrows are wanting, houses become a necessity. But they are seldom seen along the borders of deep ponds and canals, and, except in extensive swamps unbroken by hillocks, they are not found in the southern parts of the muskrat's range.

As cold weather approaches, muskrats are very active, adding to their old winter houses, building new ones, and deepening channels that lead to houses and burrows. The animals do not hibernate, and, aside from the vegetation of which their houses are made, they seem to make little provision for winter. However, some of the surplus food collected may be found in their burrows at almost any time.

BREEDING HABITS.

Published accounts of the muskrat's breeding disagree so widely that the habits of the animals might be supposed to differ in different sections of the country. Harlan states that the female brings forth 5 or 6 young annually.[a] Richardson, on the other hand, says: "In latitude 55° the musquash has three litters in the course of the season and from three to seven young in a litter."[b] Audubon and Bachman, and many zoologists since their time, repeat Richardson's statement, with slight variations that show no original research. Amos W. Butler, writing of the muskrat in Indiana, states that he is convinced that in his vicinity the animals breed but once a year, though he admits the probability of exceptions. He gives the number of young as 4 to 6 and the period of gestation as about six weeks.[c] Roderick MacFarlane, a chief factor of the Hudson Bay Company, in writing of the mammals of the Mackenzie River region, states that the female has two litters the first and three each succeeding season, and that the number of young at times varies from 8 to 20.[d]

[a] Fauna Americana, p. 133, 1825.
[b] Fauna Boreali-Americana, p. 117, 1829.
[c] American Field, XXIV, 537, 1885.
[d] Proc. U. S. Nat. Museum, XXVIII, 738, 1905.

His statements are based on information obtained from the company's Indian hunters, who are keen observers.

Some of the foregoing testimony has little weight. Also, we should be slow to accept conclusions based on the number of "kit" muskrats found occupying a winter house, for they may be either more or fewer than a full litter. The close relationship existing between this animal and the common field mouse (*Microtus*) suggests that a similarity of breeding habits is to be expected; and the investigations of the Biological Survey show that such resemblance actually exists.

Field naturalists of the survey have made two records of actual litters of muskrats. A female taken June 18, 1895, by Vernon Bailey, at Summit, Mont., contained 13 large embryos. Another, taken June 8, 1893, by J. A. Loring, at Ward, Colo., contained 8 embryos. A specimen in the United States National Museum, collected by Dr. E. A. Mearns at Newport, R. I., April 19, 1900, contained 6 small fœtuses.

The writer, in March, 1909, talked with a considerable number of muskrat trappers in Dorchester County, Md., about the breeding habits of the animals. The best informed of these men state that from three to five litters (normally but three) are produced, and that the number of young in a litter varies from 3 to 12 or even more, the average being probably 6 to 8.

In mild winters sporadic breeding occurs. Thus, in the open season of 1908–9, in January one trapper found a female that had recently suckled young, and on the same day found young near by that were only about one-third grown. Another trapper in February captured a female that contained 3 embryos, and still another, a Mr. Insley, on March 6 took a female that had 3 embryos. In discussing the date in spring at which trapping should cease, the trappers stated that each year before March 15 a number of pregnant females are caught, and that trapping should not be continued later than that date. The early spring litters, they stated, are usually below the average in size, 3, 4, and 5 being the more common numbers. The young of these early litters are said to breed the same fall.

I am indebted to R. J. Slacum, of Cambridge, Md., for a detailed account of his observations during many years while residing near the marshes and trapping in them. He confirmed the statements of the more intelligent trappers as to the number of litters and number of young; and made the interesting statement that most of the young muskrats in Dorchester County marshes are born, not in burrows, for there are few places where burrowing is possible, nor yet in winter houses, although this is occasional, but in new nests which the female builds of grasses and dry plants, but without roots or

mud. Such a nest is placed above the reach of tides in a brush pile or a bunch of growing plants. Mr. Slacum states that he has often found young muskrats in these nests, which are far less bulky than the winter houses. He is uncertain as to the duration of pregnancy in the female, but thinks it must be less than a month.

All this testimony shows that in their breeding habits muskrats are not unlike field mice. This conclusion is further strengthened by the remarkable way in which the marshes, depleted by vigorous winter trapping, are replenished before the opening of another season. The known facts may be thus summarized: Normally the animals mate in March and the first litter is born in April; a second litter is due in June or early July, and a third in August or September. In favorable seasons a fourth or even a fifth litter may be produced. The period of gestation is possibly no longer than twenty-one days, as with the common rat and probably with the field mouse. The young are blind and naked when born but develop rapidly. Outside of low marshes, muskrats are usually born in the underground burrows.

MIGRATIONS.

Muskrats often wander over fields and along highways far from water. This occurs in late fall, early spring, or during severe droughts in late summer. The causes are not understood, although the spring movement has been generally attributed to sexual excitement. When met away from water, muskrats sometimes show considerable ferocity and have been known to attack persons savagely without apparent provocation.

Whether general migrations of muskrats occasionally occur is doubtful, although the trader at Lake Traverse, Minnesota, informed Featherstonhaugh that such movements take place, and that at times the animals were seen on the prairies in incredible numbers.[a]

The local movements of muskrats from place to place, both overland and along streams, make it difficult to protect canals and artificial ponds from the animals. They promptly find their way to new ponds built several miles from their former known haunts. Irrigation canals and ditches are likewise invaded throughout their entire length so nearly simultaneously that it is hard to believe that all the animals could have reached them through the head gates.

FOOD.

Like nearly all rodents the muskrat is chiefly herbivorous, but it sometimes indulges in animal food, a habit which it shares with

[a] Featherstonhaugh's Canoe Voyage, I, 384, 1847.

brown rats, house mice, field mice, lemmings, wood rats, squirrels, and other gnawers.

In winter the chief food of muskrats consists of the roots of aquatic plants—pond lilies, arums, sedges, and the like—but in some localities the animals feed on mussels and also on carp and other sluggish fish that bury themselves in mud. When ponds are frozen over, muskrats are almost wholly restricted to food accessible under the ice, but in rare cases they have been known to leave the water and burrow under the snow in search of the crowns of grasses and sedges.

In wooded marshes near Washington, D. C., the winter food of muskrats seems to be largely roots and stems of the golden club (*Orontium aquaticum*). At New Richmond, Mich., in November, 1908, W. L. McAtee, of the Biological Survey, found the animals feeding almost entirely on fleshy tubers of a large sedge, the river bulrush (*Scirpus fluviatilis*). The writer examined 15 of the stomachs collected by Mr. McAtee at this place and found the contents to consist largely of the finely ground, starchy material from this tuber, in some instances mixed with fibrous bits of stems and roots of other aquatic plants. No animal matter was found. Some of the stomachs contained over $2\frac{1}{4}$ ounces of food, weighed when moist.

The fact that muskrats swim long distances under the ice is well known, and the generally accepted explanation is the following: When more oxygen is needed the animal comes to the top of the water and exhales its breath against the ice. After waiting a moment for the air bubble to take up oxygen the animal reinhales it and then continues its journey. Thus far, the writer has failed to observe this habit. He has several times watched muskrats swimming under the ice and coming to the surface to breathe, but in every instance he was satisfied that there was air in the space below the ice.

Although the muskrat secures air under the ice, it does not obtain enough to last it while feeding. For this purpose it must reach the outer air. The winter houses are not air-tight, and are used to some extent as dining places; but much of the food is consumed just outside of air holes in the ice, which are kept open by frequent use. Roots, leaves, stems, and grasses are hauled to the surface through these openings; and on these winter "draw-ups" the animals sit while eating. Sometimes the draw-up is roofed over with stems of plants, forming a house large enough to shelter a single muskrat.

In summer the muskrat's menu is far more extensive. It can then choose from many aquatic plants—roots, stems, leaves, and fruit—and in addition can obtain supplies from near-by fields or woods.

Muskrats are fond of nearly all garden vegetables—cabbage, onions, carrots, parsnips, beets, peas, beans, celery, and the like—and they frequently do considerable damage in gardens close to their haunts.

Much of the food collected by the muskrat in summer, whether from land or water, is consumed at the water's edge, while the animal sits on the end of a log, a pile of drift, or a draw-up. The summer draw-up is often quite bulky, showing its long use.

One frequently comes upon heaps of mussel shells, chiefly *Lampsilis* and other *Unionidæ*, on the margins of ponds and streams. The thin-shelled species frequently have the valves broken, but the heavier kinds are often without injury or tooth marks. The inference is that the unbroken mussels have been left to die and open of themselves, after which the muskrat secures the meat.

Hunters occasionally find muskrats feeding on the bodies of waterfowl that have been shot and lost on the marshes. Sometimes a duck is dragged into a muskrat house and devoured there. Muskrats have been known to attack wounded or trapped individuals of their own species, and, like field mice, when hard pressed for food are said to kill and eat the weaker members of their own community.

L. J. Cole and H. C. Tucker, of Ann Arbor, Mich., in 1901–2 kept an adult muskrat in captivity for nearly seven months for the purpose of observing its habits. It refused to eat animal food of any kind, rejecting raw beef, fish, and mussels for its favorite vegetable diet. Carrots were eaten in preference to everything else offered. Besides carrots it ate cabbage, parsnips, potatoes, turnips, corn, bread, cake, nuts (when cracked or shelled), maple bark, crab apple flowers, strawberries, stems of the common flag, and the leaves of a number of kinds of trees.[a] Such observations, while not necessarily indicative of the natural diet, show the animal's preference under the conditions imposed.

DESTRUCTIVE HABITS OF MUSKRATS.

INJURY TO GARDENS AND CROPS.

Damage to crops by muskrats is confined to limited areas. On low-lying lands bordering streams they sometimes attack corn or other grains, the injury usually being restricted to narrow belts near the water's edge. Sometimes growing corn is eaten to the ground, but the damage is greatest when it is in the roasting-ear stage. The animals then cut down the stalks to reach the ears, which they carry to their burrows. Injury to other grains, except rice, is generally slight.

Losses of garden crops on bottom lands are more serious than the losses of grain. The black alluvial soils of creek bottoms are especially adapted to growing vegetables; and to escape the effects of sum-

[a] Fourth Rept. Mich. Acad. Science for 1902, p. 199, 1904.

mer drought, the farmer, especially in some of the Western States, often chooses for the vegetable garden a plat near the water. The muskrat frequently invades such plats and destroys the vegetables.

Mr. Charles Dury, of Cincinnati, Ohio, in a letter to the Biological Survey, dated August 7, 1906, says: "While looking for insects along Duck Creek during June and July, I was greatly surprised at the damage wrought in a cabbage patch, several acres in extent, by muskrats. They had cut off and carried away almost the entire patch, having beaten paths down the bank from the plants to their burrows. The owner of the patch had placed steel traps to catch them, but evidently without success, as the area of destruction was constantly increasing."

Similar reports as to losses of turnips, celery, melons, and other crops are occasionally heard, and also losses of fallen apples when the trees are close to the water.

INJURY TO RICE.

The muskrat is an enemy of the rice planter. More than a half century ago Audubon and Bachman called attention to the fortunate circumstance that this animal was absent from the rice-growing district of the South Atlantic States, remarking that "if it existed in the banks and dikes of the rice fields, it would be a terrible annoyance to the planter, and possibly destroy the reservoirs on which his crop depend."[a]

The same fortunate condition holds for most of the rice districts of the Gulf coast; but in parts of Louisiana—which State has about half the total acreage of rice in the United States—the muskrat is a recognized pest in the plantations. It burrows in the embankments, flooding or draining the fields at the wrong time, and often feeds on the growing crop and breaks down the plants. In Plaquemines Parish planters have for years discouraged the killing of alligators, because the abundance of muskrats is attributed to a scarcity of the saurians, which have been killed for their hides.[b] A law passed by the general assembly of Louisiana in 1908 authorizes the police juries of the several parishes to enact such laws as they deem best to prevent the destruction of alligators.

INJURY TO WATER LILIES.

Where muskrats are abundant they are destructive to water lilies grown in private grounds and public parks. The animals greatly relish the tuberous and highly farinaceous roots of these plants, and

[a] Quadrupeds of North America, I, 123, 1851.

[b] American Field, XXIV, 176, 1885.

often by their depredations make it difficult to establish the lilies in new situations. The common white water lily (*Nymphæa odorata*) is said to be less subject to injury than the odorless species, while the so-called lotus (*Nelumbo*), both native and introduced species, is most frequently injured.

Dr. W. T. Hornaday testifies to the persistence of the muskrat in ornamental ponds, saying: "When three bogs in the New York Zoological Park were dug out and converted into ponds, the wild muskrats in the Bronx River found them as soon as they were completed, immediately took possession of them, and there they still remain. Being very destructive to lily bulbs and most other aquatic plants, their presence in ornamental ponds is very objectionable." [a]

INJURY TO TIDAL MEADOWS.

Along the Atlantic coast are large areas which are overflowed by salt water at highest tides, but which produce useful though coarse grasses. In some of these marshes dikes have been built over the low places to exclude the tides. The quality of the grass is thus improved and cutting by machine is made possible. The embankments have gates to permit the drainage of surface water and to admit the tides when desired. Muskrats often burrow into these dikes and flood the lands at inconvenient times. They attack the tidal gates also and gnaw holes through them, much to the annoyance of the salt-water farmer. While this flooding of meadows results in inconvenience, the losses are not great, and it is highly probable that if properly protected the muskrats would yield better returns to the owners of the land than they now obtain from the hay.

INJURY TO DAMS AND EMBANKMENTS.

The most serious damage done by muskrats is to dams and embankments. Milldams, canals, irrigation ditches, ice ponds, and river levees are more or less subject to injury from these animals. They delight in the deep water afforded by artificial reservoirs. Whenever a canal is built along a river valley, large numbers of muskrats promptly desert the river for the new waterway and pierce the embankments with their burrows. Where the berm bank of the canal is high, little harm is done on that side; but on the other bank and in places where the berm slopes downward, water often penetrates the burrows and disastrous breaks follow. It must be admitted, however, that sometimes the muskrat is blamed for breaks actually caused by crayfish, pocket gophers, moles, and even the common brown rat.

[a] American Natural History, p. 83, 1904.

Almost every season navigation on some of the principal canals of the country is suspended for a time to repair breaks caused by muskrats. The Delaware and Raritan Canal near Trenton, N. J., was injured by muskrats during the early part of December, 1899, so that the repairs required the complete cessation of navigation for several days. In September, 1894, muskrats caused several enormous breaks in the Erie Canal, one near Rochester and another on the 3-mile level near Brighton.

Injury to rice fields in the South by muskrats has already been mentioned. In the same sections costly levees protect cities and agricultural lands from overflow during freshets. Frequent breaks in these levees occasion heavy losses and much suffering. One of the most common and insidious causes of breaks is the burrows made by muskrats. So serious was the situation in Plaquemines Parish in the winter of 1908–9 that a general slaughter of muskrats took place, and fully half a million of the animals were estimated to have been killed. The pelts netted about $100,000,[a] which in some measure compensated for the losses the animals occasioned to rice and cane.

In irrigated sections of the West, ditches and reservoirs are sometimes injured by muskrats, requiring costly repairs and involving serious delays in the distribution of water to growing crops. Most canal and irrigation companies find it profitable to employ watchmen to patrol the embankments and look for burrows of muskrats, gophers, and other animals.

The breaking of milldams in districts where manufacturers depend on water power is often due to muskrat burrows. Such breaks are a source of loss to manufacturers, operatives, and the entire community. The manufacturer loses in repairs, diminished output, and loss of contracts; the operatives lose their wages; and the community loses in business dependent on the custom of operatives and, not infrequently, in destruction of property. Thus, in the spring of 1904, near Thomaston, Conn., muskrats burrowed through a dam, wrecking it and releasing the water, which injured property in the town to the extent of several thousand dollars.

In April, 1904, the waters of Saline River in southern Illinois invaded the Equality mine and threatened the lives of about a hundred miners. Investigations showed that the waters of the swollen river had reached the mine by way of muskrat burrows.

Instances of the destruction of railway embankments, due to muskrats and water, are not rare. Injury to live stock through stepping into burrows of muskrats is not infrequent; and in one instance a costly driving track which had been constructed near a marsh was abandoned because of continued burrowing beneath it by these

[a] Sport in Dixie, I, No. 2, p. 10, May, 1909.

animals. A shell road in Dorchester County, Md., was built across an extensive marsh, the superstructure resting on timbers lying on the ground. Muskrats burrowed beneath and made the road unsafe for driving and a constant source of expense to the county for repairs.

INJURY TO FISH.

While muskrats sometimes eat fish, they capture sluggish kinds mainly and seldom harm game fish. A few years ago, when German carp were introduced into many parts of this country, it was found that muskrats sometimes invaded ponds and destroyed the carp. This would not now be regarded as a serious loss.

Muskrats cause some loss to the fish culturist by injuring his ponds and possibly by destroying the food of fishes. Mr. James Annin, of the United States Fish Commission, states that the animal, in addition to undermining banks of fish ponds and eating off slats from screens, destroys the caddis worm and other fish food.[a]

ECONOMIC USES OF THE MUSKRAT.

We turn now to a discussion of the economic uses of the muskrat. Its chief value is, of course, for its fur. It is valuable also for its flesh, which is utilized for food.

THE MUSKRAT AS FOOD.

The flesh of the muskrat was generally highly esteemed by the aborigines of North America, especially in winter. The early colonists soon learned to eat the animals, and cooked them in Indian style, boiled with corn. Nearly all professional trappers, hunters, and voyageurs of the North and Northwest considered the flesh palatable, and often ate it roasted over the coals of the camp fire. Featherstonhaugh recorded seeing traders and Indians near Lac qui Parle, Minnesota, drying muskrats for food. He says: "This being the season for muskrats, as the traders call them, they had taken an immense number of them, which they had skinned, and the carcasses, which they are very fond of, were drying on sticks over a slow fire. In twenty days they had taken 1,200 of these animals."[b]

In recent years many persons of refined taste have eaten the flesh of the muskrat and considerable diversity of opinion has been expressed as to its palatability. One writer is emphatic in the opinion that its musky flavor would keep any but the starving from eating it. Another declares that the muskrat is game worthy of an epicure, with a flavor somewhat like the wild duck that has been shot in

[a] Bul. U. S. Fish Com., IV, 86, 1884.

[b] A Canoe Voyage up the Minnay Sotor, I, 312, 1847.

the same marshes where it has fed.[a] A number of persons have likened its flavor to that of the famous terrapin of the Chesapeake.

Sale in the Markets.

The fact remains that muskrats are sold extensively in some of the markets of the East and Middle West. In the retail markets of Philadelphia, Baltimore, Wilmington, and other cities they are sold as "marsh rabbits," but no attempt is made to conceal the fact that they are muskrats. They are bought and eaten both by well-to-do citizens and by the poorer people who seldom indulge in high-priced game. The animals are trapped primarily for their pelts, but after they are skinned, the additional labor of preparing the meat for market is so slight that they can be sold very cheaply.

In the Baltimore markets, February 21, 1908, I found muskrats for sale at various stalls. The retail price was 10 cents each. At the commission houses I learned that several firms receive them regularly from the lower Chesapeake. The muskrat market opens about the Christmas holidays and extends to the middle of March. The receipts for that season had been very light compared with those of the previous year, and the demand had been much greater than the supply. One commission man informed me that he had a standing order for several barrels from one of the smaller towns, but that he could not get enough to supply even the city demand. The wholesale price averaged about 7 cents.

In March, 1909, replies to inquiries at the Baltimore markets showed that during the season then closing a larger supply of muskrats had been received than usual, but, owing to the mild winter, many had arrived in unsalable condition and the wholesale price was lower than for the preceding season.

In February, 1907, the Philadelphia Record stated that a single dealer on Dock street in that city sold about 3,000 muskrats a week for food. The chief source of this supply was stated to be in the vicinity of Salem, N. J. The Saginaw (Mich.) Courier-Herald states that in the season of 1907–8 dressed muskrats at that place retailed at from 15 to 20 cents each, and that dealers had ready sale for all they could provide.

Muskrat is said to be a favorite dish at dinners given by church societies in Delaware and Maryland, and annual muskrat banquets are a feature with certain gun clubs in the West. Those of the Monroe (Mich.) Marsh Club have been celebrated for many years. Nearly a dozen years ago, when the club desired the enactment of a law to protect the muskrat on the marshes adjoining the Great Lakes, they went to Lansing, taking with them their own chefs, and invited

[a] Forest and Stream, L, 368, 1898.

the entire legislature to partake of their hospitality. The chief dish was muskrat, but no hint of what they were eating was given the legislators until the banquet was over, when the toastmaster informed the guests that the club desired to have a law passed giving protection to the excellent game of which all had just been partaking, which was muskrat. The law was passed without opposition. Since then invitations to the club's muskrat dinners have been greatly prized.

Preparing and Cooking.

The flesh of the muskrat is dark red in color but fine grained and tender. Unfavorable opinions as to its flavor arise, probably, from lack of skill in cooking or from carelessness in skinning the animal. In the usual method of skinning, the hair side of the pelts does not come in contact with the flesh, the musk glands often come off with the skin, and only in summer does the musky odor pervade the flesh. An unskilled person is more likely to leave some of the odor, but in winter it may all be removed by washing. The novice should be careful to keep the fur from touching the flesh, to avoid cutting into the musk glands, and to trim off any subcutaneous glands that may adhere to the meat.

The following recipe for cooking muskrat is taken from Forest and Stream:

Soak the carcass over night in cold water or let it freeze in the open air. Cut in pieces ready to serve and place in a pot with a few slices of salt pork. Add water enough nearly to cover the meat and stew slowly until about dry—say, for an hour and a half. Pepper and salt to taste while cooking.[a]

We are indebted to George T. Bowen, a caterer of 440 West Biddle street, Baltimore, Md., for the following recipes for cooking muskrat:

Fried muskrat.—Wash the muskrat thoroughly and cut in quarters. Let it lie in salt water for an hour or more, then wash, dry with a cloth, and season. Dip the pieces in a prepared egg batter and dust them with flour or meal.

Place the lard in a frying pan and let it get hot. Then put in the muskrat and fry very slowly for an hour. Prepare a gravy of milk, butter, flour, and parsley, and season it to taste. After it thickens pour it over the cooked muskrat.

Roast muskrat.—Wash the meat thoroughly, let it lie for an hour or more in salt water, and then wash again.

Put it in a pan with water, salt, pepper, butter, and a little onion; sprinkle flour over it, and baste it until it is thoroughly done.

Stewed muskrat.—Wash the meat thoroughly, cut it in pieces, and let it lie in salt water for an hour. Then wash again, put it in a sauce pan, and season with butter, salt, and pepper to taste.

Let it simmer slowly, and when nearly done put parsley and a little chopped onion into it. When entirely done thicken with a gravy of flour and water, as for stewed chicken.

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[a] Forest and Stream, L, 368, 1898.

The slightly gamey flavor of muskrats prepared by the above recipes is liked by most persons. Should it be objectionable it may be overcome by soaking the meat overnight in salt water.

MUSKRAT FURS.

In the raw state the fur of the muskrat is dense and soft and in general appearance much like that of the beaver. However, the pelage is shorter and less close and the pelt somewhat inferior in durability. The color varies with season and locality. Northern skins are said to average lightest in color, being often a light silver gray, sometimes nearly white on the underparts. This is probably because many are taken in summer pelage. Very dark skins, classed as black, come mainly from New Jersey, Delaware, and Maryland, but are found in limited numbers in other parts of the United States and in Canada.

Compared with most other furs of such small size, muskrat furs are of excellent quality and durability; their cheapness is chiefly the result of their abundance. The earliest demand for the fur was for the manufacture of so-called beaver hats, it making an excellent imitation. When silk replaced fur in hat manufacture, the demand for muskrat skins fell off greatly. They next became popular as imitations of sealskin. Properly dyed and made up, they are difficult to distinguish from the genuine, but their wearing qualities are greatly inferior. The modern fur dresser and dyer have found means of imitating nearly all the more costly furs with that of this animal, and have thus created a continuous demand for the pelts.

Trade in Muskrat Furs.

The growth of the demand for muskrat furs is shown by the records of London importations and sales. From 1763 to 1800 (thirty-eight years) the total number of skins imported and sold in that market was 2,831,453, an average of less than 75,000 yearly. During the fifty years from 1801 to 1850 the total was 20,571,428, or an average of 411,000 yearly. From 1851 to 1890, inclusive, the importations were 99,893,591, a yearly average of 2,500,000. The average London sales in recent years have been over 4,000,000 per annum, and the entire output of skins for 1900 was 5,285,000.[a] A large part of the total collection is sold through London, but in the last few years an increasing number are dressed and manufactured in America.

Notwithstanding that during the past century and a half nearly a quarter billion of muskrats have been trapped, the supply has not greatly diminished. The total output of 1905, as indicated by Lon-

[a] Rept. U. S. Com. Fish and Fisheries for 1902, p. 285, 1904.

don sales of 5,000,000 skins in 1906, was over 7,000,000. The sale of these was accompanied by an advance of 40 per cent in prices. The

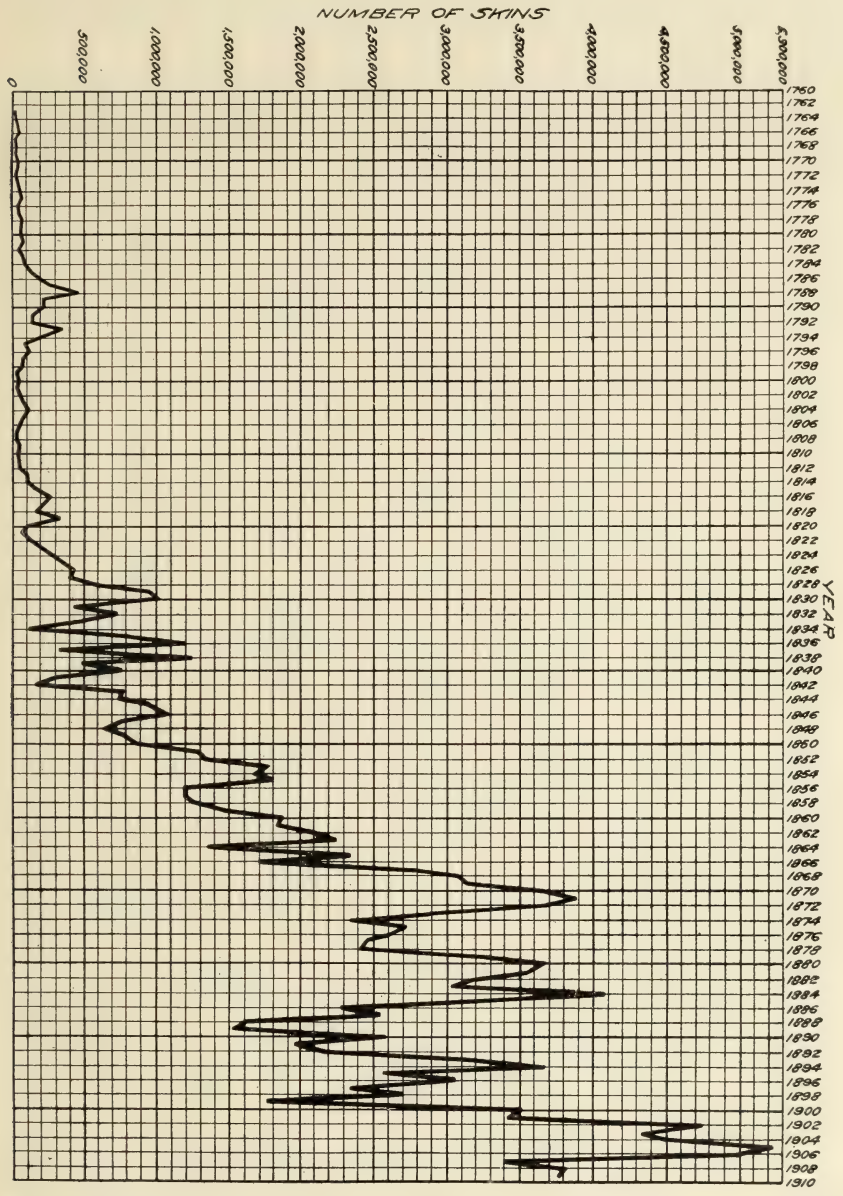

FIG. 3.—Diagram showing number of muskrat skins sold in London each year from 1763 to 1909.

sales for 1907 showed a further advance of about 25 per cent, but a falling off in the offerings of fully 1,500,000 skins. The London

sales for 1908 and 1909 showed still further rise in prices, which were again advanced in the January and March sales of 1910. The total London sales for 1908 were 3,806,000; for 1909, 3,771,000. Fig. 3 shows the variation in the numbers of muskrat skins sold in London, 1763 to 1909.[a]

Information from dealers in raw furs in the Chesapeake region indicates that the supply of muskrat furs has been reasonably steady in spite of the prevailing high prices. Baltimore buyers paid 35 cents each for brown and 45 cents for black, ungraded, during the season of 1909. New York buyers offered higher prices, but the furs are graded in that market. On January 22, 1910, Baltimore buyers were paying 65 cents for brown and 70 cents for black skins, ungraded. Trade quotations in The Trapper's World for February, 1910, list No. 1 black muskrat skins at $1 each. Prices are, of course, based on returns from the London auctions and must be low enought to permit a reasonable profit to dealers.

In order to dispose of furs to advantage, trappers should keep informed as to market values. Usually they can realize fair returns by selling to local buyers and at the same time run but slight risk of having the pelts graded too low. There has been much complaint of the practice of dealers in sending out circulars offering high prices for furs to induce shipments. Upon receipt of consignments, however, the furs are so much undergraded that the returns are far less than could have been realized in the local market.

Trapping the Muskrat.

Muskrats are not suspicious and are easily trapped. They take any suitable bait readily, especially in winter and early spring, when green food is scarce. The majority of those captured in the ordinary steel trap are caught by the front leg. A strong trap breaks the leg bone and in struggling the animal is apt to tear loose, leaving a foot, or part of it, in the trap. For this reason the traps should be set so that the captives will quickly drown.

The best baits for muskrat are carrots, sweet apples, parsnips, turnips, or pieces of squash. Many trappers use scent to attract the animals, but it is doubtful if the smell of musk or of any of the oils, as anise or rhodium, has advantages over the natural odor of the baits named.

Most muskrat trappers use the ordinary steel trap (No. 1). The manner of setting it depends upon the situation, and the skill of the trapper is best displayed in selecting this. Muskrat trails may be found along the banks of all streams and ponds which they inhabit,

[a] Statistics are taken from Poland's "Fur-Bearing Animals" and from "Fur Trade Review," 1891 to 1909.

and the practiced eye can often trace them into shallow water. Sink the trap in the trail, partly in the mud or sand where the water is 2 or 3 inches deep, and fasten the chain to a stake, or, better still, to a slender pole reaching into deep water. The pole, upon which the ring of the chain is to slide, should have a fork at the outer end to prevent the ring from slipping farther, and the other end should be stuck firmly into the bank. Fasten the bait to a stick set in the mud, so that the bait is about a foot above the pan of the trap. The animal in reaching for the bait sets the hind foot upon the pan and is caught more securely than if taken by the fore foot. It immediately plunges into deep water, sliding the chain along the pole as far as it will go, and soon drowns. If the chain is fastened to a stake, it should be planted in water a foot or more in depth, so that the animal will drown.

Besides this water set for the steel trap, other situations will suggest themselves to the intelligent trapper. One of the best is in the opening of the animal's burrow in the bank. Here no bait is required. Sometimes a spade is needed to cut out a piece of turf and make room for the trap, the top of which should be at least 2 inches under water.

When ponds are frozen over, traps are often set in the muskrat houses, the trapper going to them on the ice; but this practice destroys the houses and is not to be commended. Trapping near the houses in open water is far better, although it is not always possible to use a boat in the shallow marshes to which the muskrat resorts. When the houses are not far from the bank, a long plank about 5 or 6 inches wide may be used advantageously as a support for traps. It is moored to the shore by a wire passed through a staple driven into one end of the plank, while the other end projects into the pond or rests against the side of the muskrat house. Light cleats are nailed to the upper side of the plank at intervals, with space enough between them to hold a trap when set. The ring at the end of each trap chain is fastened to the plank by a staple. A plank will hold a trap for each foot of its length. Baits of carrot or apple may be scattered along the plank; but they are not necessary, since the animals use such a plank as a highway to reach the shore. An animal venturing upon the plank is almost sure to be caught. In this way most of the occupants of a house may sometimes be taken on one plank in a single night. A floating log, or one extending out into the water, may be used in a similar way as a support for traps. Shallow notches wide enough to hold the traps may be cut into it, and the traps covered lightly with fine leaves or grass.

The box trap is a favorite with some trappers. They use a long wooden box whose cross section inside is about 6 by 6 inches and

which has a gate at each end. The gates are of wire and arranged to swing inward but not outward. The box is set just under water with one end at the entrance to a muskrat burrow. The animal lifts the gate on leaving the burrow and is imprisoned and drowned. Others follow until perhaps all the occupants of the burrow are caught. A similar trap may be made entirely of heavy wire netting of half-inch mesh, bent to shape. These traps are well adapted to very narrow streams or ditches.

An open barrel sunk near the bank of the stream or pond frequented by muskrats is said to be an effective trap. The top of the barrel should be level with the surface of the ground. The barrel is half full of water, upon which pieces of carrot or apple are floating. A piece of board about 8 inches square, or a few floating chips, will delude the animals into jumping into the barrel to secure the food.

A floating barrel is said to be a good substitute for a sunken barrel. A hole 8 to 12 inches square is sawed in the side of a barrel having both ends intact. A strong cleat is nailed across each end, projecting 6 or 8 inches on the sides. Upon the projecting cleats boards as long or somewhat longer than the barrel are nailed. Enough water is placed in the barrel to make it float with the outer platform level with the surface of the pond—say, with about one-third of the surface of the barrel exposed (fig. 4). Apples or carrots are placed in the barrel for bait.

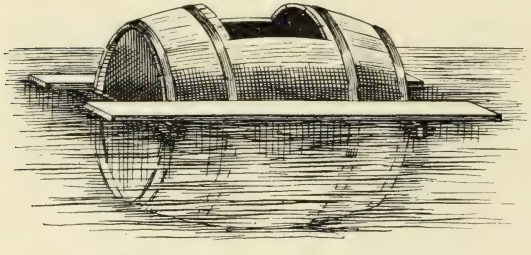

FIG. 4.—Floating muskrat trap.

Another way of taking the muskrat is to spear it inside its winter house. This is a common Indian method; but it should not be encouraged. Not only are the pelts injured by the spear, but when the ponds are ice bound, the animals that escape the spear often perish after their houses are destroyed.

Trapping was at one time a popular calling in the United States; but fur-bearing animals have so decreased in numbers that nowadays few persons earn a livelihood by trapping alone. The business is usually followed for a few weeks or months in winter. A large part of the supply of muskrat fur is taken by boys, who adopt this method of earning a little extra spending money. They often attend school, and look after the traps in the morning and evening. However, on the larger marshes of the country, muskrat trapping has recently become a regular business of considerable importance.

Caring for the Skins.

Muskrats taken for the fur should be trapped—not shot or speared. If taken alive in a trap they should be killed by a sharp blow across the back of the head. Trappers usually carry a short club for this purpose.

Muskrat skins intended for the market should be "cased," not opened along the belly. In skinning, trappers begin at the heel and slit up the middle of the hind leg to the tail, around it, and then down the other leg to the heel in the same way. No other cuts in the skin are needed, though many trappers pass the knife around the feet, where the long fur ends. The skin is then turned back over the body, leaving the fur side inward. The skin peels off easily to the front feet. The trapper cuts closely around nose, ears, and lips, so as not to tear the skin. If bits of flesh adhere to the skin about the head, they may be scraped off, but this is usually left for the fur dresser. The skin, inside out, is stretched over a thin board or a shingle of the proper shape (fig. 5), and a tack or two is inserted to keep it in position until dry. Skins should be dried in the open air—not before a fire or in the sun. They should not be exposed to rain. Books on trapping usually give full directions for caring for raw furs.

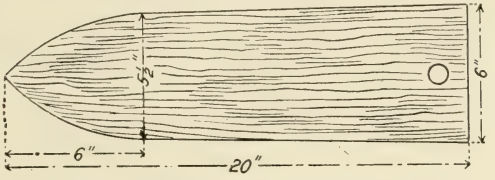

FIG. 5.—Stretcher for muskrat skins.

Home Dressing of Furs.

Formerly many muskrat skins were home tanned and made into caps, collars, and other articles. At present the home utilization of skins is much less extensive, but knowledge of a good method of dressing the fur is still desirable. Most of the methods employed by amateurs involve the use of alum to fix the hair; but satisfactory results, so far as pliability of the pelts goes, depend largely upon the amount of labor bestowed on them.

A method in common use is the following: The skins are thoroughly cleaned in warm, not hot, water and all flesh and fat scraped off. They are then stretched on a board with the fur side down and covered with a mixture of two ounces each of salt and alum, 3 gills of water, and a drachm of sulphuric acid. Thicken this with wheat bran or flour and allow it to dry on the skin. When dry, the flour or bran should be scraped off, the skin removed from the board and rolled with the fur side in. The folded skin is then drawn quickly

many times through an iron ring. It should be unfolded at intervals and rerolled in another direction. This is continued until the entire skin is soft and flexible.

The following method was recommended by the late William Hamilton Gibson:

The skin should always be thoroughly cleaned in warm water and all fat and superfluous flesh removed. It should then be immersed in a solution made of the following ingredients: Five gallons of cold soft water, 5 quarts wheat bran, 1 gill of salt, and 1 ounce of sulphuric acid. Allow the skin to soak in the liquid for four or five hours. If the hides have been previously salted, the salt should be excluded from the mixed solution. The skins are now ready for the tanning liquor, which is made in the following way: Into 5 gallons of warm soft water stir 1 peck of wheat bran and allow the mixture to stand in a warm room until fermentation takes place. Then add 3 pints of salt and stir until it is thoroughly dissolved. A pint of sulphuric acid should then be poured in gradually, after which the liquor is ready. Immerse the skins and let them soak for three or four hours. The process of fleshing follows. This consists of laying the skin, fur side down, over a smooth beam and working over the flesh side with a blunt fleshing tool. An old chopping knife or a tin candlestick forms an excellent substitute for the ordinary fleshing knife, and the process of rubbing should be continued until the skin becomes dry, when it will be found to be soft and pliable.[a]

Dressing for the Manufacturer.

Many of the muskrat skins used by American manufacturers of fur garments are now dressed in the United States. Formerly nearly all were dressed in Europe and came back to the United States largely as manufactured furs, dyed to imitate the pelts of other animals. Great improvements in the process of dressing the skins have been made in this country, as is shown by comparison of those dressed here in the natural color with the plucked and dyed skins commonly returned from abroad. Yet it must be confessed that the back strips taken from winter and spring muskrats are made into garments that very closely resemble those of fur seal. After the cased raw skins are bought in London, many are split into back and belly strips, and the backs, plucked and dyed a rich seal brown, are resold to fur manufacturers at the Leipzig sales.

The operation of dressing muskrat skins is rather complicated, and to the uninitiated the various processes seem needlessly numerous. The following is abridged from an account written by Mr. Charles H. Stevenson:[b]

At the fur dresser's the skins are first dampened on the flesh side with salt water and left all night to soften. The following morning they are placed in

[a] Camp Life and the Tricks of Trapping, p. 227, 1881.

[b] Report of Commission of Fish and Fisheries for 1902, p. 315, 1904.

a tramping machine, where they are tramped for eight or ten hours. The machine works about 2,000 pelts at a time.

The pelts are next covered with a mixture of sawdust and salt water and remain so overnight. The following morning they are cut open down the front and are then fleshed, one man being able to flesh 200 to 300 in a day. The skins are next stretched and hung up to dry. When thoroughly dry, they are again moistened with salt water on the leather side, remaining so overnight. They are next brushed on the flesh side with animal fat—butter or fish oil and tallow—and laid in pairs with the fur side out. After remaining overnight they are placed in tramping machines and worked for six or eight hours, or until thoroughly soft and pliable. They are then stretched in every direction.

The next process is cleaning. The skins to the number of 300 or 400 are placed with sawdust in revolving drums exposed to steam heat. They are revolved for about three hours, when the sawdust will have completely absorbed the grease. The skins are next incased in a beating drum, where they are revolved for two or three hours. On removal they are beaten with rattans and the fur is cleaned with a comb. The heavier pelts are fleshed down thin, thus completing the operation of dressing for the majority of skins. A small percentage are plucked or perhaps dyed. In either case they have to be cleaned once more before the process is complete.

Manufactures of Muskrat Furs.

Besides the considerable use of muskrat skins for manufacture into garments in imitation of high-grade furs, a good proportion of the poorer skins are used in the natural color for lining overcoats and other outer garments. One cause for the increased demand for fur linings is the great influx of settlers into the Northwestern States, Canada, and Alaska, where in winter the warmest garments are absolutely necessary. Garments made from skins of wolves, goats, or dogs partly supply this need, but cloth outer garments with linings of light furs are fully as warm and are less burdensome. The growing popularity of the automobile for outdoor recreation in winter is another cause for the increased demand for fur-lined coats.

The better grades of muskrat furs, dressed in the natural color, have a beautiful luster, and make really handsome coats, boas, and muffs; and many smaller articles of apparel, as collars, gloves, caps, and the like, are made of muskrat fur.

MUSKRAT FARMING.

Fur farming has been a favorite topic for discussion in American newspapers. While many fur-producing enterprises have been planned and some actually begun, few have prospered. Various difficulties have discouraged the majority of persons who have engaged in raising minks, foxes, or skunks. However, the possibilities of such enterprises have not really been tested, and present prices for these furs might well repay investment of capital in their production.

Until recently the price of muskrat fur has not been high enough to warrant expenditures on preserves, or even efforts to prevent poaching. With present conditions, carefully guarded preserves will yield steady and profitable returns. All that is needed is care not to deplete the fur supply by too close trapping.

Some Examples.

Muskrat farming is already a prosperous business. The Cedar Point Hunting Club, of Toledo, Ohio, controls 5,000 acres of marsh at the mouth of the Maumee River, near Lake Erie. In the winter of 1903–4, after the muskrats had been undisturbed for two years, they were trapped for the benefit of the club. Five thousand were taken in a single month (January, 1904), and the skins were sold for 25 cents each. The carcasses also were sold at a dollar a dozen.[a]

The muskrat industry has probably reached its highest present development on the eastern shore of Maryland. The extensive marshes of Dorchester County are a center of muskrat fur production, and the writer recently visited that section to learn about this industry.

Formerly the owners of marshes in this vicinity paid little attention to them. The land was considered useless because subject to tidal overflow. Trappers were allowed to take muskrats wherever they chose, and a dozen years ago much of the marsh land could have been bought for less than 50 cents an acre. At the present time some of the marshes are worth more, measured by the actual income from them, than cultivated farms of like acreage in the same vicinity. The increased values are due to the muskrat. Landowners now usually lease the trapping privilege, and trappers and owners unite to protect the marshes from poaching. The owner receives half the fur caught, while the trapper gets the other half and all he can realize from the sale of the meat. In the short season of seventy-four days, January 1 to March 15, during the last two years, trappers have easily made from $400 to $900 each.

A few specific examples will give a better idea of the value of these marsh lands. The owner of one tract of marsh informed the writer that he bought it three or four years ago for $2,700. It is leased for half the fur, and yielded him in 1909 $890, or about 33 per cent on the investment. The owner of a small piece of marsh—about 40 acres—bought it in 1905 for $150. Leased for half the fur, it has yielded the owner $30, $60, $70, and $100, respectively, for each of the four years, 1906 to 1909. Taxes are very light, and on the basis of a 6 per cent income the returns for 1909 would represent an approximate value of nearly $40 an acre for this land. The

[a] Fur Trade Review, p. 96, February, 1904.

owner of a 1,300-acre tract of marsh trapped it this season, with the aid of his sons, and secured over 5,000 muskrats, which were sold for $2,300.

The furs sold in this region are seldom assorted before sale. They are separated into black and brown and then counted, a deduction of from 3 to 5 per cent being made for "kitts." The skins sold throughout the present season at Baltimore prices, 35 cents for brown and 45 cents for black. The proportion of black skins varies on the different marshes from 10 to 60 per cent, the average being about 40 per cent.

The muskrat meat is an additional source of income to the trapper. It is bought by local buyers, who during the season 1909 paid only 4 cents for each animal; it is shipped to outside markets or sold for local consumption. The demand for the meat is growing, and all of it is utilized. The Baltimore market takes about 30,000 animals during a season, the bulk of which come from Dorchester County.

The editor of the Cambridge Record, a local newspaper, stated that the muskrat industry of Dorchester brings into the county about $100,000 annually. This would indicate that about a quarter million of the animals are trapped each season. The danger of exhausting the supply by continued close trapping has been discussed in Dorchester County, but trappers maintain that with the long closed season, March 15 to January 1, little ground for anxiety on this score exists.

Possibilities of the Business.

Muskrats require no feeding, since the plant life of ponds and marshes furnishes abundance of food. In many States the areas adapted to the muskrat are extensive, and doubtless the animals could be profitably introduced into sections from which they are now absent. As trapping is done in winter, the business of muskrat farming is peculiarly adapted to farmers and farmers' boys.

The improvement of the muskrat's pelage by selective breeding has never been attempted. Probably the black muskrat could be bred true to color and greatly improved in the localities it now inhabits, and could be successfully introduced into other sections of the country. Indeed, to make the most of the muskrat industry requires that the possibilities of selective breeding be tested.

THE MUSKRAT AS A PEST.

Its destructive habits make the muskrat a pest in comparatively few places. On the whole, and especially in large marshes and uninhabited sections, its economic value far outweighs the harm it does. On many of the streams it inhabits, no attempts have been made to

impound water for use, and hence the animal does not interfere with engineering operations. In all such situations and in swamps the animal should have ample protection to insure a present and future fur supply. The present value of the pelt is an incentive to excessive trapping.

MEANS OF DESTRUCTION.

Mill owners and superintendents of canals, irrigation works, and levees are sometimes confronted with the necessity for active operations against muskrats, and should know the more effective methods of fighting them. It must be confessed that the usual means have not been very successful. Rewards for killing them have never effected more than a temporary reduction of their numbers. Shooting ordinarily makes the survivors exceedingly wary. While trapping is more successful, it can seldom be carried to the limit of practical extermination.

Methods of trapping are effective in both summer and winter, but when green food is abundant greater care is needed in the selection of baits. With enough steel traps placed in favorable locations the danger to embankments may be greatly diminished. The barrel trap will sometimes bring quicker relief, since it often captures an entire family of muskrats at one setting. Whenever possible, trapping these animals should be deferred until their skins are prime.

Although muskrats are hard to poison, they can be destroyed more rapidly by poisoning than by trapping. Strychnine is usually preferable to other poisons. Powdered strychnia sulphate sweetened with powdered sugar or commercial saccharin and sprinkled over freshly cut pieces of apple, carrot, or ripe squash has proved effective in many cases. Crystals of the same poison inserted in the baits with a knife have also given good results. Care must be taken to keep poisoned baits where they will not endanger other valuable wild or domestic animals.

PROTECTING PROPERTY FROM MUSKRATS.

The use of concrete foundations of proper depth for dams reduces to a minimum the danger of injury from muskrats.

Probably the most successful means of protecting earthen embankments is to employ a skillful trapper to patrol them regularly, using traps, poisons, and a small caliber rifle. The patrol is usually charged with the additional duty of watching for and promptly repairing slight breaks in the embankments.

Several methods of keeping muskrats from injuring small ponds have been recommended. One is the liberal use of gravel or coarse

sand for the surface of embankments, since the animals will not burrow in soil that fills the hole as fast as they open it.

The best means of protecting the vegetable garden from muskrats is to erect a fence of netting, either surrounding the garden or skirting the bank of the stream or pond. The netting should be of galvanized wire 3 feet or more in width and of an inch and a half mesh. The lower edge should be sunk 6 inches into the soil to prevent the animals from digging under.

ENEMIES OF THE MUSKRAT.

Man is by no means the only destroyer of the muskrat. Among its natural enemies are the coyote, fox, mink, the larger hawks and owls, and the pickerel. But all of these enemies together do not greatly affect the number of muskrats.

Next to trapping, floods and droughts destroy the largest numbers. Richardson was the first to record the effect of the elements on the muskrat. He states that inundations destroy many and that in parts of the country severe winters extirpate them by freezing the swamps and shallow ponds solid and that then they die of famine or destroy each other. Also they die in large numbers from some unknown cause. Sometimes the decrease is so great that fur posts have to be abandoned.[a]

R. MacFarlane says that seasons of high water favor the propagation of the muskrat, while summers of drought and continued low-water limit increase and also cause much mortality during the succeeding winter. He adds that in some years many thousands of the animals perish miserably under the ice and in their frozen up "washes" or winter homes; also that many die of disease.[b] MacFarlane cites these facts in explanation of the great fluctuation in the number of muskrat skins collected from year to year in northwest Canada. However, the prolific breeding of the animals during one or two favorable seasons usually restores the normal numbers.

The proposed reclamation of swamps and marsh lands throughout the country, if carried out, will greatly reduce the number of muskrats by restricting their habitat; and if the supply of this fur is to be maintained, it must be through protection and eventually through private ownership.

PROTECTIVE LAWS.

From an economic point of view the protection of fur-bearing animals is just as important as the preservation of game; but, until recently, laws for their protection have been few. A number of

[a] Fauna Boreali-Americana, p. 117, 1829.

[b] Proc. U. S. Nat. Mus., XXVIII, 737, 1905.

States now protect the beaver absolutely, but in most of them the laws came too late to accomplish much good. A majority of the Northern States now have a closed season for certain fur bearers, and in some of them the muskrat is specifically included; but in most parts of the United States inhabited by this animal it may be killed at any time and in any manner.

CLOSED SEASONS.

Nearly all the Canadian provinces protect the muskrat by a closed season. These include Alberta, Manitoba, New Brunswick (certain counties), Nova Scotia, Ontario, Quebec, Prince Edward Island, and Saskatchewan. In the United States 13 States have laws affording partial protection to the muskrat, as follows:

Delaware.—The closed season for muskrats is March 20 to December 1. Muskrats may not be hunted by use of lights at night, nor in Kent County during freshets that drive them from their usual abodes.

Illinois.—No fur-bearing animals may be captured for profit between May 1 and November 1.

Iowa.—Muskrats are protected from April 1 to November 1, except when found damaging private or public property.

Maine.—The closed season on muskrats extends from May 1 to October 15, but a few towns have special laws relating to these animals. The legislature of 1909 changed the opening date for trapping muskrats from December 1 to October 15, a change that no consideration can justify.

Maryland.—Closed season April 1 to January 1. Seven counties have different closed seasons as noted below. Ten counties have no protection for muskrats.

Anne Arundel County.—The closed season for muskrats is from March 1 to December 1. It is unlawful to destroy muskrat dens or houses.

Caroline County.—Closed season April 1 to December 15.

Dorchester County.—Closed season March 15 to January 1. It is unlawful to use artificial light in taking these animals.

Kent County.—It is unlawful to use light in hunting muskrats.

Somerset County.—Closed season March 15 to December 15. Unlawful at all times to shoot muskrats.

Talbot County.—Closed season March 15 to December 1.

Wicomico County.—Closed season March 15 to December 15.

Patuxent River marshes.—Muskrats may not be shot from two hours after sunset to one hour before sunrise.

Michigan.—Muskrats may not be killed from April 15 to October 31, both dates included. It is unlawful to destroy muskrat houses at any time or to set traps within 6 feet of a muskrat house. The owner of property may destroy the animals on his own premises when it can be shown that they are doing damage.

Minnesota.—Muskrats are protected April 15 to November 15. Muskrat houses are protected at all times. The animals may be killed at any time by the owner of property injured by them.

New Jersey.—Muskrats may not be killed April 1 to December 1, except on embankments or on lands protected from overflow by embankments. This law was passed January 21, 1829.

New York.—The closed season for muskrats is May 1 to October 15. They shall not be possessed or killed during this time.

North Carolina: *Columbus County.*—All fur-bearing animals are protected April 1 to January 1, except that two townships have closed season March 1 to December 1.

Currituck Sound.—It is unlawful to shoot muskrats on marsh lands on the east side of Currituck Sound after sundown or before sunrise between October 1 and March 31.

South Dakota.—Muskrats are protected April 1 to November 15, except when they destroy property. Town supervisors may employ others to kill or trap muskrats to protect public highways. Trappers not residents of the State must take out a license before trapping; fee $10.

Virginia.—Shooting muskrats by night is unlawful in tidewater districts of the State.

Accomac County.—Muskrats are protected March 15 to January 1.

Wisconsin.—Muskrats may not be taken by spear or gun. The closed season extends from May 1 to November 1. Occupants or owners of lands on the shores of certain rivers and lakes may take muskrats in any manner from October 25 to May 1, but may not dispose of pelts before the general open season. Owners of cranberry marshes are allowed to kill the animals at any time when they are destroying dams.

Previous to the passage of the present law, a prominent fur buyer of Michigan estimated that the trappers of that State would be benefited $100,000 a year by the passage of a law prohibiting the taking of fur in September and October.[a] The muskrat pelt taken in October or November is worth scarcely half as much as if trapped in February. Trappers are still careless of their own interests, and in their eagerness to forestall competitors take the field far too early. Fur dealers, on the other hand, have generally deprecated this policy, and have endeavored to secure reform. A prominent firm, extensive buyers of raw furs, in 1904 sent out a circular asking for cooperation to secure laws protecting all fur-bearing animals from May 1 to November 1. While the movement is in the right direction, it would not, if carried out, prove adequate to correct all the evils of unseasonable trapping. Muskrats within the United States should not be trapped before December 15; and while the fur is still prime in the latter part of March, the breeding season is then on, and continued trapping would greatly limit the number of animals for the next season. The open season for the muskrat should be limited to three months, from December 15 to March 15, or in the more northern States from December 1 to March 1.

SUMMARY.

Muskrats are of much economic value, and should be protected by proper laws. Legal enactments should forbid their destruction

[a] Fur Trade Review, p. 118, March 1, 1895.

during the reproducing season and whenever their furs are not prime. Spearing and shooting should be prohibited. Muskrat houses should be protected at all times. The trapping season should be nearly uniform for the different States.

Protective laws should contain provisions allowing corporations and individuals whose property is being damaged by muskrats to destroy the animals in the closed season under the supervision of game wardens or other officers, but not for profit.

If properly protected the muskrat will continue to inhabit our rivers and ponds for an indefinite period, and to furnish a stock of furs for our own and future generations.